Sure-Lites 3 Phase Inverter **System**

4.8 kW – 16.7 kW

Users Manual

C A U T I O N

READ ENTIRE MANUAL AND REVIEW ALL DOCUMENTATION BEFORE ATTEMPTING SYSTEM INSTALLATION

FOR SERVICE OR INSTALLATION INFORMATION:
TELEPHONE: (610) 868-5400 (24 HR. HOTLINE)
FAX: (610) 954-8227

FOR YOUR PROTECTION

PLEASE COMPLETE AND RETURN WARRANTY REGISTRATION CARD IMMEDIATELY.

This unit contains LETHAL VOLTAGES. All repairs and service should be performed by AUTHORIZED SERVICE PERSONNEL ONLY! There are NO USER SERVICEABLE PARTS inside this unit.

IMPORTANT SAFEGUARDS

When using electrical equipment, you should always follow basic safety precautions, including the following:

1. **READ AND FOLLOW ALL SAFETY INSTRUCTIONS.**
2. **Do not install the system outdoors.**
3. **Do not install near gas or electric heaters or in other high-temperature locations.**
4. **Use caution when servicing batteries. Depending on battery type, batteries contain either acid or alkali and can cause burns to skin and eyes. If battery fluid is spilled on skin or in the eyes, flush with fresh water and contact a physician immediately.**
5. **Equipment should be mounted in locations where unauthorized personnel will not readily subject it to tampering.**
6. **The use of accessory equipment not recommended by *COMPANY* may cause an unsafe condition and void the warranty.**
7. **Do not use this equipment for other than its intended use.**
8. **Qualified service personnel must perform all servicing of this equipment.**

SAVE THESE INSTRUCTIONS

The installation and use of this product must comply with all national, federal, state, municipal, or local codes that apply. If you need help, please call Service.

User’s Guide
An on-site permanent log of the inspection, testing, and maintenance of the emergency electrical power supply system shall be maintained in accordance with the Manufacturer's operating manual. The log shall include:

The date on which the inspection, testing, and maintenance exercise was carried out

The name of the person(s) who performed the inspection, testing, and maintenance.

A note of any unsatisfactory condition observed or discovered, and the steps taken to correct the condition

C H A P T E R 1

INTRODUCTION

Keep this manual and the System Installation Guide in the folder mounted inside the unit.

This unit is a microprocessor controlled PWM (Pulse Width Modulated) pure sine wave based DC to AC power inverter utilizing IGBT technology. It integrates a fully automatic 3-rate battery charger, a solid-state transfer system, control circuitry, self testing and recording digital meter display, and maintenance free sealed lead calcium type batteries. The system components are carefully matched to make the unit a completely self-contained, fully automatic standby power source for operation on all types of lighting loads. The batteries are sized and tested per UL-924 and Life Safety Code ANSI / NFPA 101, providing emergency power for a minimum of 90 minutes.

If the duration of a power failure is greater than the batteries storage capability, the inverter will automatically shut down when the battery voltage reaches 85% of the nominal DC voltage. This feature protects the battery from being permanently damaged from a deep discharge that could cause cell reversal. This battery protection feature is called "Low Voltage Disconnect" or L.V.D.

When the AC power is restored after a full discharge, the system will be ready for another power failure within 24hrs. If another power failure occurs before the 24-hour recharge time, the run time will be decreased.

The front panel display incorporates an alphanumeric 2x20 LCD character display, LED status indicators and a 4 x 4 keypad. All user interface functions are available from the front panel assembly.

Utilizing a small footprint, this unit is for use with any lighting load including quartz, HID, incandescent, fluorescent and halogen.

HOW TO USE THIS MANUAL

This manual tells you how to start, operate, and communicate with your unit and lets you know how to get more information for special situations.
Please record your unit's model number, serial number, and part number below. You can find these numbers on the labels on the inside panel.

Model Number _____

Serial Number _____

Part Number _____

Service and Support

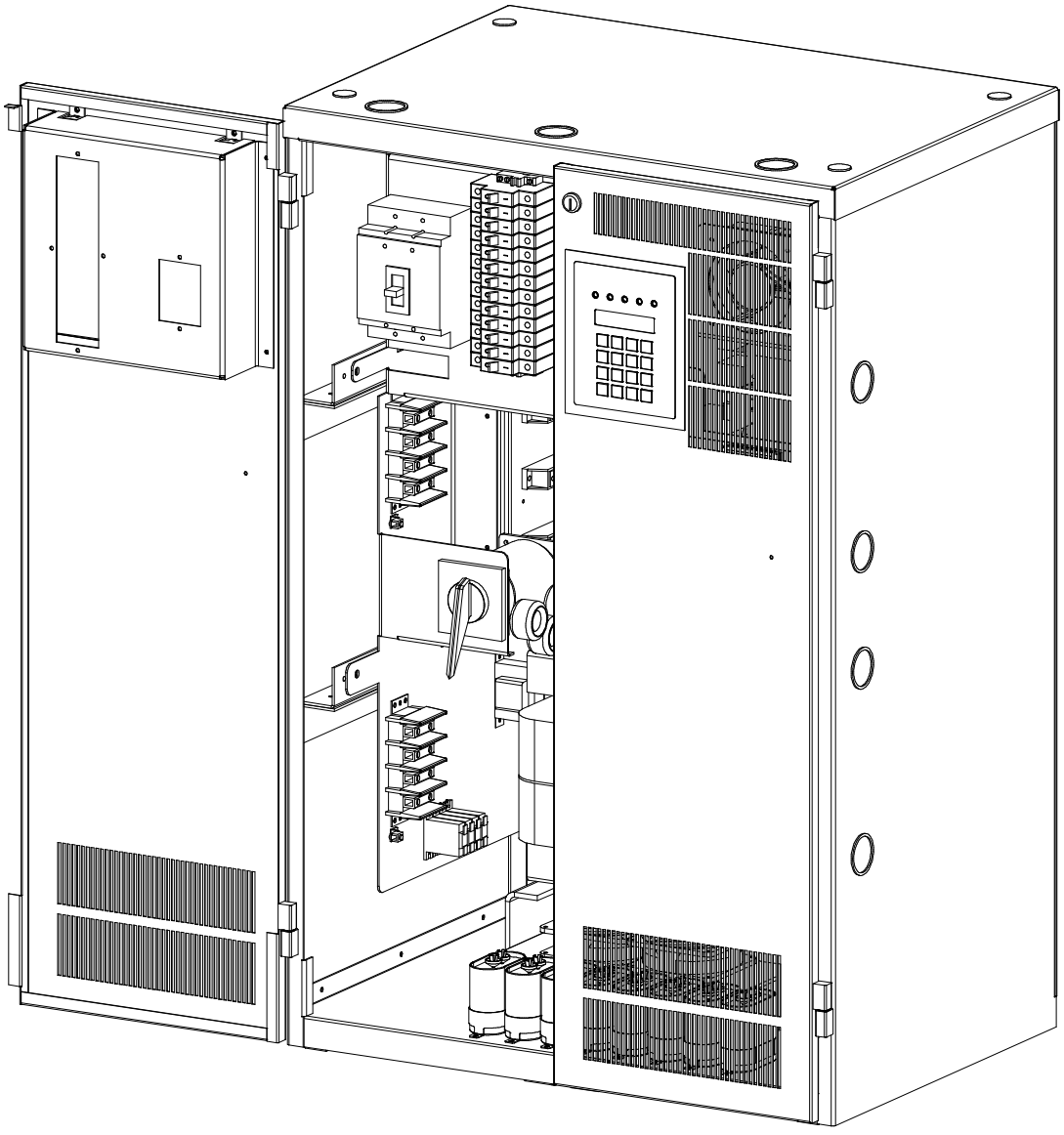
We are committed to outstanding customer service. A service technician is available **24** hours a day, **365** days a year. Service is also available **24** hours a day to give you access to technical notes and product information. You can also visit our web site.

NOTE: Please have your unit's Serial and Model numbers available when you call; this number is located behind the right door.

Contact SERVICE one of the following ways:

Service Number: 610-868-5400

Service Fax: 610-954-8227



CHAPTER 2

Environment

Make sure the environment is a clean, cool, dry place with normal ventilation.

Storage Temperature

Store the batteries (in the system or battery cabinet) at -18 to 40°C (0 to 104°F). Batteries have a longer shelf life if they are stored below 25°C (77°F). Keep stored batteries fully charged. Recharge the batteries every 90–120 days. The system or battery cabinet without batteries may be stored at -20 to 70°C (-4 to 158°F).

Ventilation

The air around the unit must be clean, dust-free, and free of corrosive chemicals or other contaminants. Do not place the system or batteries in a sealed room or container.

Operating Temperature

System can operate from 20° to 30°C (68° to 86°F) and up to 95% relative humidity. The batteries' service life is longer if the operating temperature stays below 25°C (77°F).

Batteries

The temperature should be near 25°C (77°F) for optimum battery performance. Batteries are less efficient at temperatures below 18°C (65°F), and high temperatures reduce battery life. Typically, at about 35°C (95°F), battery life is half of what it would be at a normal temperature of 25°C (77°F). At about 45°C (113°F), battery life is one-fourth of normal.

Make sure that heaters, sunlight, air conditioners, or outside air vents are not directed toward the batteries. These conditions can make the temperature within battery strings vary, which can cause differences in the batteries' voltages. Eventually, these conditions affect battery performance.

If the batteries are not in the system, remember that the batteries should be installed as close as possible to the unit to reduce DC wiring costs and improve battery performance.

Do not allow tobacco smoking, sparks, or flames in the system location because hydrogen is concentrated under the vent cap of each cell of the battery. Hydrogen is highly explosive, and it is hard to detect because it is colorless, odorless, and lighter than air.

Every type of battery can produce hydrogen gas, even sealed maintenance-free batteries. The gas is vented through the vent caps and into the air, mainly when the unit is charging the batteries. The batteries produce the most hydrogen when maximum voltage is present in fully charged batteries; the batteries do not produce hydrogen during float charging. The amount of current that the charger supplies to the batteries (not the battery ampere-hour) determines how much hydrogen is produced.

High Altitude Operation

The maximum operating ambient temperature drops 1°C per 300m (2°F per 1000 ft) above sea level. Maximum elevation is 3000m (10,000 ft).

C H A P T E R 3

Startup and Shutdown Procedure

Refer to the Installation Manual to secure the unit and install AC and DC wiring.

STARTUP PROCEDURE

For the initial startup of the system, follow the instructions in the Startup and Warranty Validation Form. Failure to do so will void warranty.

CAUTION: HAZARDOUS VOLTAGES – ONLY QUALFIED SERVICE PERSONNEL SHOULD PERFORM PROCEDURE.

1. Verify that the installation switch located on the inverter chassis is in the OFF position. Verify that AC input is disconnected.

2. Press and hold the DC Pre-charge switch located on the inverter chassis for approximately five seconds and then install the battery fuse. If a large flash occurs, the batteries are not connected properly. Call service immediately.

3. Energize the Mains AC input by turning on the units input circuit breaker and/or the Distribution Panel breaker located upstream from the inverter.

4. Turn the installation switch to the On position. The Front Panel display should now be illuminated and a slight hum should be heard from the inverter transformer. The unit is now charging and the output should be energized.

SHUTDOWN PROCEDURE

1. Interrupt the AC Mains to the machine by the Distribution Panel Breaker or the machines input circuit breaker. The Inverter should then start.

2. Turn the installation switch located on the inverter chassis to the off position. The inverter should stop.

3. Disconnect the main battery fuse located on the inverter chassis.

CAUTION: HAZARDOUS VOLTAGES STILL EXIST AT THE BATTERY TERMINAL BLOCK AND WITHIN THE SYSTEM. AUTHORIZED SERVICE TECHNICIANS MUST DISCHARGE DC CAPACITORS AND TURN OFF UTILITY POWER BEFORE SERVICING EQUIPMENT.

CAUTION: DO NOT LEAVE THE SYSTEM SHUTDOWN FOR A PROLONGED LENGTH OF TIME. LEAD BASED BATTERIES WILL EXPERIENCE PERMANENT DAMAGE FROM LACK OF CHARGING AFTER A FEW MONTHS.

CHAPTER 4

OPERATION

The following is a description of the status LED's located on the front panel.

AC Present

When the AC Mains is present, the LED will illuminate. If a power failure was long in duration, or the AC mains was disconnected by some other means (Circuit breaker open) the AC Present LED would not be illuminated. When the control circuit senses that the line has dropped below an acceptable level (Black Out, Brown Out, or Transient), the inverter will energize for at least one minute. So, if the power failure was a momentary glitch, the AC present LED would be illuminated but the inverter would be running.

System Ready

When the system has adequate battery voltage to transfer, the System Ready LED will illuminate. This feature prevents damage from multiple deep discharges of the battery.

Battery Charging

When the AC Mains is connected to the line and the battery is charging under normal conditions, the Battery Charging LED will illuminate.

Battery Power

When the inverter is producing output power (battery is being discharged), the Battery Power LED will be illuminated.

Fault

This is a summary Fault indication. When there is a fault condition present, the Fault LED will illuminate. To view which fault is present, use the keypad and LCD display feature.

The front panel display will provide the user with a variety of information. It has a full compliment of Meter functions, Control functions and Program functions.

C H A P T E R 5

Front Panel Display

The Front panel consists of a 2 x 20 alpha numeric LCD display with LED Back lighting, 5 Status LED indicators and a 4 x 4 keypad for user interface.

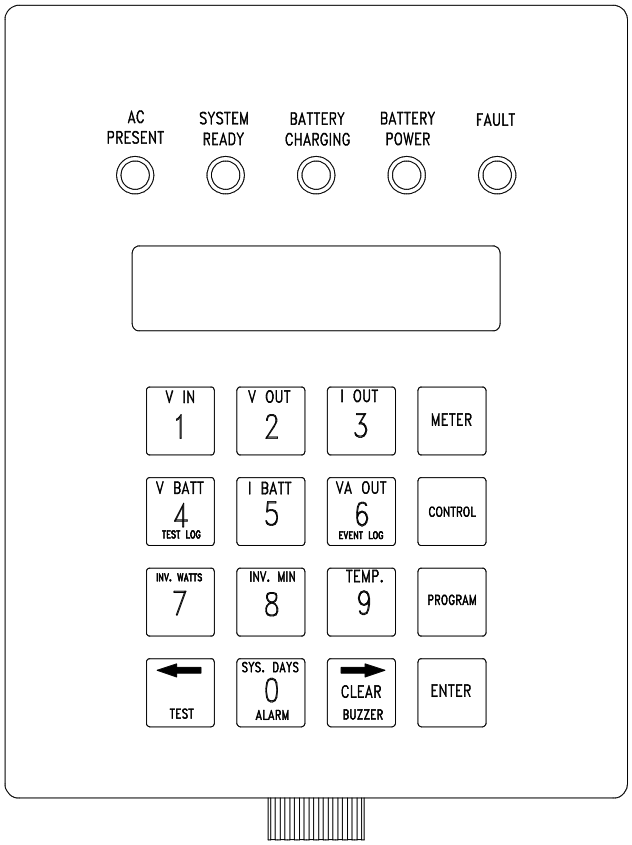


Figure 5.1 Front Panel Display

Control Panel Keypads

Table 5.1 Keypad Functions

Key Name	Description
Meter (Blue)	Pressing this key will activate Meter Functions
Control (Red)	Pressing this key will activate Control Functions
Program (Black)	Using this key, you can enter passwords or change parameter values. To enter passwords, press [PROGRAM], enter the password, and press [ENTER]. NOTE: A password must be entered to change parameters.
Enter (Grey)	This key records or enters a task you perform using the control panel keys.
[?]	This key functions as Left scroll key
[?]	This key functions as Right scroll key
[0]	This key works as a number key; it is also used to display active alarms when in CONTROL Mode.
[1] through [9]	These keys work as number keys.

Meter Functions

Meter functions are available by pressing the **METER** keypad to get to the Meter Menu and then pressing the desired function keypad. (See figure 5.1)

Table 5.2 Meter Functions

Function	Description	Keypad Text
Voltage Input	Measures the AC Input Voltage to the Inverter	V IN
Voltage Output	Measures the AC Output Voltage from the Inverter	V OUT
Current Output	Measures the AC Output Current from the Inverter. If optional Normally Off loads is connected, it will read the sum of Normally On and Normally Off outputs.	I OUT
Battery Voltage	Measures Battery Voltage	V BATT
Battery Current	Measures the Battery Current. When in charge mode, the current will be positive. When in Inverter mode, the current will be negative.	I BATT
VA Output	Multiplication of the output voltage and output current	VA OUT
Inverter Watts	Multiplication of the battery voltage and the battery current	INV. WATTS
Inverter Minutes	Total minutes the system has run on inverter	INV. MIN
Temperature	Measures the ambient temperature of the electronics enclosure.	TEMP
System Days	Total days the system has been in service.	SYS. DAYS

Control Functions

Control functions are available by pressing "CONTROL" to get to the Control Menu and then pressing the desired function.

Table 5.3 Control Functions

Function	Keypad Text
Test Log	TEST LOG
Event Log	EVENT LOG
Initiate Test	TEST
Alarm Log	ALARM
Buzzer Silence	BUZZER

- TEST LOG - View the Test Log of the last 75 monthly or Yearly Tests. View the Date, Time, Duration, Output Voltage, Output Current, Temperature and Fault Status.
  Use the left and right scroll key to change event number.
  Use the ENTER key to select desired event number.
  Use the left and right scroll key to view event information about the event.
  Use the TEST LOG key to return to the event number.

- EVENT LOG - Identical to the TEST LOG except this log records the past 75 events.

- TEST - Pressing the TEST key will initiate a 1-minute test. This test will be recorded in the Event log since it is not part of the scheduled monthly or yearly test.

- ALARM - View the Alarm log of the last 50 alarms. View the Date, Time and Alarm.
  Use the left and right scroll key to change alarm number.
  Use the enter key to select alarm number.
  Use the left and right scroll key to view information about the alarm.
  Use the ALARM key to return to event number.

- BUZZER - Pressing this key silences the audible buzzer from a fault condition or an intermittent beep when the inverter is under battery power. If a fault caused the buzzer to alarm and the alarm is silenced, the buzzer will return after 24 hours or after the fault is cleared.

Program Functions

User Program Functions

All program functions are password protected. The password for user level is 1234. When the PROGRAM keypad is pressed, the display will prompt the user for the password. After the password is entered (1234 + ENTER key), the user can change the Date, Time, Month Test Date, Month Test Time, Yearly Test Date and Yearly Test Time, Load Reduction Fault, Low VAC Alarm, High VAC Alarm, Ambient Temp Alarm and Near Low Battery settings.
Time is always in the 24 hour standard. Example 4:00 PM is 16:00.

Table 5.4 Program Functions

Parameter	Format	Factory Default
Date	MM/DD/YY (Month, Date, Year)	Current Date
Time	HH/MM (Hours, Minutes)	Eastern Stand Time
Monthly Test Date	DD (Date)	15th of the Month
Monthly Test Time	HH/MM (Hours, Minutes)	5:00
Yearly Test Date	MM (Month)	01
Yearly Test Time	HH/MM (Hours, Minutes)	8:00
Load Reduction	AAAA(Amps)	0.0A
Low VAC Alarm	VVVV(Volts)	1.0V
High VAC Alarm	VVVV(Volts)	999.9V
Ambient Temp Alarm	DDD(Degrees Centigrade)	70C
Near Low Battery	VVVV(Volts)	See Table 5.5

- Near Low Battery Voltage is in VVVV (Volts). The last digit entered is after the decimal place. I.E. (430 + ENTER) will register 43.0VDC. Please refer to table 5.5.

- Load Reduction Fault is in AAAA (Amps). The last digit entered is after the decimal place. I.E. (480 + ENTER) will register 48.0 Amps. If the output current under battery power is 10 percent below this number, the alarm will be set.

- Low AC Voltage Alarm is in VVVV (Volts). The last digit entered is after the decimal place. I.E. (1200 + ENTER) will register 120.0 Volts. If the Input AC Voltage goes below this number the alarm will be set.

- High AC Voltage Alarm is similar to Low AC Voltage Alarm.

- Ambient Temperature Alarm is in DDD (Degrees Centigrade). I.E. (75 + ENTER) will register 75 deg. C. When the ambient temperature internal to the inverter enclosure goes above the set point the alarm will be set.

Table 5.5 Near Low Battery Voltage

DC VOLTAGE	NEAR LOW BATTERY
144VDC	130VDC
180VDC	162VDC
240VDC	216VDC

CHAPTER 6

SPECIFICATIONS

Sure-Lites 3 Phase

General Specifications

Input	Voltage	120/208 or 277/480Vac 3-phase 4-wire +10% -15%.
	Input Power Walk-in	Limiting inrush current to less than 125%, 10 times for 1 line cycle
	Input Frequency	60Hz, +/- 3%, 50Hz Available upon request
	Synchronizing Slew Rate	1Hz per second nominal
	Protection	Input Circuit Breaker
	Harmonic Distortion	< 10%
	Power Factor	.5 lag/lead
Output	Voltage	120/208 or 277/480Vac 3-phase 4-wire.
	Static Voltage	Load current change +/-4%, battery discharge +/-4%
	Dynamic Voltage	+/- 3% for +/-25% load step change, +/-6% for a 50% load step change, recovery within 3 cycles
	Harmonic Distortion	< 3% THD for linear load
	Output Frequency	60Hz +/- .05Hz during emergency mode
	Load Power Factor	.5 lag to .5 lead
	Inverter Overload	115% for 5 minutes
	Protection	Output Cicuit Breaker
Battery	Type	Valve-regulated sealed lead-calcium. Contact factory for additional battery types.
	Charger	Microprocessor controlled for various battery types and temperature compensating (recharge per UL924 spec)
	Protection	Automatic low-battery disconnect; automatic restart upon utility return.
	Disconnect	Fuse- and-Fuse/ Circuit Breaker above 24KVA
	Optional Runtimes	Extended runtimes available. Consult factory for additional information.
Environmental	Altitude	< 10,000 feet (above sea level) without derating
	Operating Temperature	20 to 30 degree Celsius
	Storage Temperature	-20 to 70 degrees Celsius (electronics only)
	Relative Humidity	< 95% (non-condensing)
General	Design	Stand-By UPS. PWM inverter type utilizing IGBT technology with 2mS transfer time.
	Generator Input	Compatible with generators.
	Control Panel	Microprocessor controlled 2 x 20-charactor Display with touch pad controls & functions 5 LED indicators & alarm with ring-back feature
	Metering	Input & Output Voltage, Battery Voltage, Battery & Output Current, Output VA, Temperature, Inverter Wattage
	Alarms	High/Low Battery Charger Fault, Near Low Battery, Low Battery, Load Reduction Fault, Output Overload, High/Low AC Input Volts, High Ambient Temperature, Inverter Fault, Output Fault, Optional Circuit Breaker Trip
	Communications	RS-232 port (DB9)
	Manual Maintenance Bypass	Standard
	Alarm Contacts	Optional Summary Form "C" Contacts
	Warranty	1 year standard warranty includes all parts, labor, & travel expenses within 48 contiguous states. Up to 10 years prorated warranty on batteries. Extended warranties, preventative maintenance and customized service plans are available.
	Factory Start-up	Purchase factory start-up & receive 1 additional year of warranty.
	5 Year Service Plan	Purchase 5 year service plan & receive free factory start-up.
Physical	Cabinet	Freestanding NEMA Type 1
	Cooling	Forced Air, during emergency mode.
	Cable Entry	Top or Side
	Access	Front

C H A P T E R 7

MAINTENANCE AND SERVICE

The Self-testing feature of the inverter ensures that the system is tested at least once per month for 5 minutes and once per year for 90 minutes. If there are any problems with the self-tests, the fault log shall indicate which faults occurred. Please see the fault descriptions and troubleshooting guide.

A few simple maintenance operations performed periodically will help ensure many years of trouble free operation. Battery terminals should be checked for tightness and corrosion. If severe corrosion is evident, maintenance is required to correct this situation.

Since the unit depends on unrestricted airflow for cooling of power handling components, it is important to keep the air vents free of any obstruction. If the environment tends to be extremely dusty, occasionally blow away any accumulation of dust on components. Please follow the shutdown procedure before cleaning.

CAUTION: Follow the shutdown procedure (See Chapter 3) before cleaning. An authorized technician only should perform Service!

Table 7.1 Preventive Maintenance Schedule

SERVICE TO PERFORM:	PERFORM SERVICE EVERY:		
	3 MONTHS	6 MONTHS	12 MONTHS
1. TEST UNIT: **NOTE:** Perform manual test only when critical load is connected but not required. ----- Output voltage should be present. ----- Confirm operations of front panel indicators.	**X**		
2. **INSPECT BATTERIES:** ----- All connections are tight. ----- Connections have no corrosion. (Clean if necessary).		**X**	
CLEAN UNIT: NOTE: Unit must be shut down during this service. ----- Inspect air vents and clean if necessary. ----- Clean excessive dust from inside cabinet(s). ----- Clean excessive dust from fan(s).			**X**

"X" Indicates when to perform service. Lines below the "X" are for the date of service.

TROUBLE SHOOTING CHART

THE NUMBER IN THE CHART INDICATES ORDER IN WHICH PROBLEMS SHOULD BE CHECKED	SYMPTOMS	Inverter will not run during a power failure	System draws excessive AC input current	System noisy, excessive transformer hum during normal run conditions	AC output voltage low during a utility power failure	System overheats, smells, smokes, etc.	System noisy, transformer hum during a power failure	Inverter jitters or staggers during a power failure	System blows battery fuse (& fuses in battery cabinet if applicable)	Charger not charging properly, batteries low or dead	Charger stays in HI charge	Batteries require continuous addition of water to keep proper level (optional w/ wet cells)	Battery acid leaking in cabinet or around tops of batteries	Battery voltage does not read properly after Installation of fresh cells	Battery Voltage low or non existent
PROBLEMS															
Installation switch on inverter in off position		1													
Shorted IGBT module(s)		3			3	3		1	3						
No AC input voltage										2					
Defective inverter		4			2	2	1	3	5						
Output volt-ampere rating of unit being exceeded		6	1		1	1	2	2	6						
Ambient temperature too high, vents blocked												3	1		
Shorted load			2		4		3								1
Reverse battery diodes shorted									2						
Open battery fuse (& fuses in battery cabinet if applicable)		2													
Battery polarity wrong									1						
Defective charger		11		1		4				6	1	1	2	4	2
Battery capacity low		7												3	3
Low water in battery (optional w/ wet cells)		10								3					4
Wrong amount of battery cells in series		9		2		6			4	4	2	2	4	1	5
Batteries dead, low or defective		8								5	3	4	3	2	
Transfer module and/or control circuit malfunction		5													
Transformer not connected for proper voltage			3	3		5				1					